

Dictionary of Electrical and Computer Engineering

Petitioner has added romanettes to pages i-iv. Otherwise, it leaves the original page numbering.

AMAZON.COM, INC. ET AL.
EXHIBIT 1017

McGraw-Hill

**Dictionary of
Electrical and
Computer
Engineering**

McGraw-Hill

New York Chicago San Francisco Lisbon London Madrid
Mexico City Milan New Delhi San Juan Seoul Singapore
Sydney Toronto

All text in the dictionary was published previously in the McGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, Sixth Edition, copyright © 2003 by The McGraw-Hill Companies, Inc. All rights reserved.

McGRAW-HILL DICTIONARY OF ELECTRICAL AND COMPUTER ENGINEERING, copyright © 2004 by The McGraw-Hill Companies, Inc. All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

1 2 3 4 5 6 7 8 9 0 DOC/DOC 0 9 8 7 6 5 4

ISBN 0-07-144210-3



This book is printed on recycled, acid-free paper containing a minimum of 50% recycled, de-inked fiber.

This book was set in Helvetica Bold and Novarese Book by TechBooks, Fairfax, Virginia. It was printed and bound by RR Donnelley, The Lakeside Press.

McGraw-Hill books are available at special quantity discounts to use as premiums and sales promotions, or for use in corporate training programs. For more information, please write to the Director of Special Sales, Professional Publishing, McGraw-Hill, Two Penn Plaza, New York, NY 10121-2298. Or contact your local bookstore.

Library of Congress Cataloging-in-Publication Data

McGraw-Hill dictionary of electrical and computer engineering.

p. cm.

ISBN 0-07-144210-3

1. Computer engineering—Dictionaries. 2. Electric engineering—Dictionaries.

TK7885.A2M37 2004
004'.03—dc22

2004049888

Contents

Preface	v
Staff	vi
How to Use the Dictionary	vii
Fields and Their Scope	ix
Pronunciation Key	xi
A-Z Terms	1-642
Appendix	643-679
Equivalents of commonly used units for the U.S.	
Customary System and the metric system	645
Conversion factors for the U.S. Customary System,	
metric system, and International System	646
Standard equations	651
Special constants	655
Physical constants	656
Electrical and magnetic units	657
Dimensional formulas of common quantities	658
Internal energy and generalized work	658
Trigonometric functions	659
General rules of differentiation and integration	661
Basic integral transforms	664
Mathematical notation	665
Schematic electronic symbols	672
Partial family tree of programming languages	677
ASCII code	678
Electromagnetic spectrum	681
Microwave frequency bands	681
Radio spectrum	682

alphanumeric characters [COMPUT SCI] All characters used by a computer, including letters, numerals, punctuation marks, and such signs as \$, @, and #. Also known as alphanumeric characters. { 'al-fa-nū;mer-ik 'kar-ik-təz }

alphanumeric display device [ELECTR] A device which visibly represents alphanumeric output information from some signal source. { 'al-fa-nū;mer-ik dis'plā di,vīs }

alphanumeric instruction [COMPUT SCI] The name given to instructions which can be read equally well with alphabetic or numeric kinds of fields of data. { 'al-fa-nū;mer-ik in'strək-shən }

alphanumeric pager [COMMUN] A receiver in a radio paging system that contains a device which can display text or numeric messages. { 'al-fa-nū;mer-ik 'pā-jər }

alphanumeric reader [ELECTR] A device capable of reading alphabetic, numeric, and special characters and punctuation marks. { 'al-fa-nū;mer-ik 'rēd-ər }

alpha test [COMPUT SCI] A test of software carried out at the user's location and using actual data. { 'al-fa,təst }

alpha test site [COMPUT SCI] A place where a complete computer system is tested with actual data and transactions. { 'al-fa,təst,sīt }

alternate-channel interference [COMMUN] Interference that is caused in one communications channel by a transmitter operating in the next channel beyond an adjacent channel. Also known as second-channel interference. { 'ōl-tər-nāt 'chan-əl in-tər'fir-əns }

alternate index See secondary index. { 'ōl-tər-nāt 'in,dəks }

alternate key [COMPUT SCI] A key on a computer keyboard that does not itself generate a character but changes the nature of the character generated by another key when depressed simultaneously with it; similar to the control and shift keys. Abbreviated ALT key. { 'ōl-tər-nāt,kē }

alternate routing [COMMUN] The operation of a switching center when all circuits are found busy in a programmed route to the destination, and the call is offered to another programmed route. { 'ōl-tər-nāt 'rūt-ɪŋ }

alternate track [COMPUT SCI] The disk track used if, after a disk volume is initialized, a defective track is sensed by the system. { 'ōl-tər-nāt 'trak }

alternating current [ELEC] Electric current that reverses direction periodically, usually many times per second. Abbreviated ac. { 'ōl-tər,nād-ɪŋ 'kər-ənt }

alternating-current circuit theory [ELEC] The mathematical description of conditions in an electric circuit driven by an alternating source or sources. { 'ōl-tər,nād-ɪŋ 'kər-ənt 'sər-kat ,thē-ə-rē }

alternating-current coupling [ELECTR] A coupling which passes alternating-current signals but blocks direct-current signals. { 'ōl-tər,nād-ɪŋ 'kər-ənt 'kəp-ɪŋ }

alternating-current/direct-current [ELECTR] Pertaining to electronic equipment capable of operation from either an alternating-current or

direct-current primary power source. { 'ōl-tər,nād-ɪŋ 'kər-ənt dɪ'rekt 'kər-ənt }

alternating-current dump [ELECTR] The removal of all alternating-current power from a computer intentionally, accidentally, or conditionally. { 'ōl-tər,nād-ɪŋ 'kər-ənt 'dʌmp }

alternating-current erase [ELECTR] The use of an alternating current to energize a tape recorder erase head in order to remove previously recorded signals from a tape. { 'ōl-tər,nād-ɪŋ 'kər-ənt ə'rās }

alternating-current erasing head [ELECTR] In magnetic recording, an erasing head which uses alternating current to produce the magnetic field necessary for erasing. { 'ōl-tər,nād-ɪŋ 'kər-ənt ə'rās-ɪŋ ,hed }

alternating-current generator [ELEC] A machine, usually rotary, which converts mechanical power into alternating-current electric power. { 'ōl-tər,nād-ɪŋ 'kər-ənt 'jen-ə,rād-ər }

alternating-current magnetic biasing [ELECTR] Biasing with alternating current, usually well above the signal frequency range, in magnetic tape recording. { 'ōl-tər,nād-ɪŋ 'kər-ənt mag'ned-ik 'bī-as-ɪŋ }

alternating-current motor [ELEC] A machine that converts alternating-current electrical energy into mechanical energy by utilizing forces exerted by magnetic fields produced by the current flow through conductors. { 'ōl-tər,nād-ɪŋ 'kər-ənt 'mōd-ər }

alternating-current network [ELEC] An electrical network that has elements with both resistance and reactance. { 'ōl-tər,nād-ɪŋ 'kər-ənt 'net ,wɜrk }

alternating-current power supply [ELEC] A power supply that provides one or more alternating-current output voltages, such as an ac generator, dynamotor, inverter, or transformer. { 'ōl-tər,nād-ɪŋ 'kər-ənt 'paʊ-ər sʌ,plī }

alternating-current resistance See high-frequency resistance. { 'ōl-tər,nād-ɪŋ 'kər-ənt ri'zɪs-təns }

alternating-current transmission [ELECTR] In television, that form of transmission in which a fixed setting of the controls makes any instantaneous value of signal correspond to the same value of brightness for only a short time. { 'ōl-tər,nād-ɪŋ 'kər-ənt tranz'mish-ən }

alternating voltage [ELEC] Periodic voltage, the average value of which over a period is zero. { 'ōl-tər,nād-ɪŋ 'vɒl-tɪj }

alternator [ELEC] A mechanical, electrical, or electromechanical device which supplies alternating current. { 'ōl-tər,nād-ər }

altitude delay [ELECTR] Synchronization delay introduced between the time of transmission of the radar pulse and the start of the trace on the indicator to eliminate the altitude/height hole on the plan position indicator-type display. { 'al-tə ,tūd di'lə }

altitude hole [ELECTR] The blank area in the center of a plan position indicator-type radarscope display caused by the time interval between transmission of a pulse and the receipt of the first ground return. { 'al-tə,tūd ,hɒl }

conductance-variation method [ELEC] A technique for measuring low admittances, measurements in a parallel-resonance circuit with the terminals open-circuited, with the unknown admittance connected, and then with the unknown admittance replaced by a known conductance standard are made; from them the unknown can be calculated. {kan'dak-tans ver-ē'ā-shan ,meth-ad}

conducted interference [COMMUN] Interfering signals arriving by direct coupling such as on communications and power lines. {kan'dak-tad ,in-tar'fir-ans}

conduction [ELEC] The passage of electric charge, which can occur by a variety of processes, such as the passage of electrons or ionized atoms. Also known as electrical conduction. {kan'dak-shan}

conduction cooling [ELECTR] Cooling of electronic components by carrying heat from the device through a thermally conducting material to a large piece of metal with cooling fins. {kan'dak-shan ,kü-lig}

conductive coupling [ELEC] Electric connection of two electric circuits by their sharing the same resistor. {kan'dak-tiv 'kap-lig}

conductive gasket [ELEC] A flexible metallic gasket used to reduce radio-frequency leakage at joints in shielding. {kan'dak-tiv 'gas-kat}

conductive interference [ELECTR] Interference to electronic equipment that originates in power lines supplying the equipment, and is conducted to the equipment and coupled through the power supply transformer. {kan'dak-tiv ,in-tar'fir-ans}

conductivity [ELEC] The ratio of the electric current density to the electric field in a material. Also known as electrical conductivity; specific conductance. {kan,dak'tiv-ad-ē}

conductivity bridge [ELEC] A modified Kelvin bridge for measuring very low resistances. {kan,dak'tiv-ad-ē ,brij}

conductivity cell [ELEC] A glass vessel with two electrodes at a definite distance apart and filled with a solution whose conductivity is to be measured. {kan,dak'tiv-ad-ē ,sel}

conductivity ellipsoid [ELEC] For an anisotropic material, an ellipsoid whose axes are the eigenvectors of the conductivity tensor. {kan,dak'tiv-ad-ē i'lip,soid}

conductivity modulation [ELECTR] Of a semiconductor, the variation of the conductivity of a semiconductor through variation of the charge carrier density. {kan,dak'tiv-ad-ē ,mäj-ä'lā-shan}

conductivity modulation transistor [ELECTR] Transistor in which the active properties are derived from minority carrier modulation of the bulk resistivity of the semiconductor. {kan,dak'tiv-ad-ē ,mäj-ä'lā-shan tran'zis-tar}

conductivity tensor [ELEC] A tensor which, when multiplied by the electric field vector according to the rules of matrix multiplication, gives the current density vector. {kan,dak'tiv-ad-ē ,ten-sor}

conductor [ELEC] A wire, cable, or other body or medium that is suitable for carrying elec-

tric current. Also known as electric conductor. {kan'dak-tar}

conductor skin effect See skin effect. {kan'dak-tar ,skin i'fekt}

conduit [ELEC] Solid or flexible metal or other tubing through which insulated electric wires are run. {kän-da-wat}

cone [ENG ACOUS] The cone-shaped paper or fiber diaphragm of a loudspeaker. {kõn}

cone antenna See conical antenna. {kõn an'ten-ä}

cone loudspeaker [ENG ACOUS] A loudspeaker employing a magnetic driving unit that is mechanically coupled to a paper or fiber cone. Also known as cone speaker. {kõn 'läud ,spøk-är}

cone speaker See cone loudspeaker. {kõn ,spøk-är}

conference communications [COMMUN] Communications facilities whereby direct speech conversation may be conducted between three or more locations simultaneously. {kän-frans kə ,myü-na'kä-shanz}

configuration [COMPUT SCI] For a computer system, the relationship of hardware elements to each other, and the manner in which they are electronically connected. [SYS ENG] A group of machines interconnected and programmed to operate as a system. {kan,fig-yä'rā-shan}

confirmation message [COMPUT SCI] A message that appears on a computer screen asking the user to confirm an action that could have destructive effects, such as loss of data. {kän-fär'mā-shan ,mes-i}

conformable optical mask [ELECTR] An optical mask made on a flexible glass substrate so that it can be pulled down under vacuum into intimate contact with the substrate for accurate circuit fabrication. {kan'fö-r-mä-bal ,äp-tä-kal 'mask}

conformal array [ELECTR] An array-type antenna in which the radiating elements are mounted on a surface shaped for other purposes, such as aerodynamics, or on a surface more convenient of beneficial than a plane. Circular or cylindrical arrays provide an antenna-pattern consistency particularly valuable in TACAN, IFF, and secondary radar applications. {kan'fö-r-mäl ä'rä}

confusion jamming [ELECTR] An electronic countermeasure technique in which the signal from an enemy tracking radar is amplified and retransmitted with distortion to create a false echo that affects accuracy of target range, azimuth, and velocity data. {kan'fyü-zhan ,jam-i}

confusion matrix [COMPUT SCI] In pattern recognition, a matrix used to represent errors in assigning classes to observed patterns in which the i th element represents the number of samples from class i which were classified as class j . {kan'fyü-zhan ,mä-triks}

congruential generator [COMPUT SCI] A method of generating a sequence of random numbers $x_1, x_2, \dots$ in which each member is generated from the previous one by the formula $x_{i+1} \equiv ax_i + b$ modulus m , where a, b , and m are constants. {kän,grü'en-chal 'jen-ä ,räd-är}

direct broadcast radio satellite

home consumer terminals. Abbreviated DBS. { dā'rekt 'brōd,kast-ŋ 'sād-əl,ŋ 'sis-təm }

direct broadcast radio satellite [COMMUN] A satellite in geosynchronous orbit that broadcasts radio programming directly to inexpensive home, car-mounted, and portable radio receivers. { di'rekt 'brōd,kast 'rād-ē-ō 'sād-əl,ŋ 'ŋ }

direct code [COMPUT SCI] A code in which instructions are written in the basic machine language. { dā'rekt 'kōd }

direct connect modem [COMMUN] A device that transforms binary signals into electronic pulses (as opposed to sound modulations) that can be carried over a communications channel. { dā'rekt kə'nekt 'mō,dem }

direct control [COMPUT SCI] The control of one machine in a data-processing system by another, without human intervention. { dā'rekt kən'trōl }

direct control function See regulatory control function. { dā'rekt kən'trōl 'fəŋk-shən }

direct-coupled amplifier [ELECTR] A direct-current amplifier in which a resistor or a direct connection provides the coupling between stages, so small changes in direct currents can be amplified. { dā'rekt 'kəp-əld 'am-plā,fī-ər }

direct-coupled FET logic [ELECTR] A logic gate configuration used with gallium arsenide field-effect transistors operating in the enhancement mode, whose low power consumption and circuit simplicity lead to high packing density and potential use in very large-scale integrated circuits. Abbreviated DCFL. { dā'rekt 'kəp-əld 'fē,tē'tē 'lāj-ik }

direct-coupled transistor logic [ELECTR] Integrated-circuit logic using only resistors and transistors, with direct conductive coupling between the transistors; speed can be up to 1 megahertz. Abbreviated DCTL. { dā'rekt 'kəp-əld trānzis-tər 'lāj-ik }

direct coupling [ELECTR] Coupling of two circuits by means of a non-frequency-sensitive device, such as a wire, resistor, or battery, so both direct and alternating current can flow through the coupling path. { dā'rekt 'kəp-līŋ }

direct current [ELEC] Electric current which flows in one direction only, as opposed to alternating current. Abbreviated dc. { dā'rekt 'kə-rənt }

direct-current amplifier [ELECTR] An amplifier that is capable of amplifying dc voltages and slowly varying voltages. { dā'rekt 'kə-rənt 'am-plā,fī-ər }

direct-current circuit [ELEC] Any combination of dc voltage or current sources, such as generators and batteries, in conjunction with transmission lines, resistors, and power converters such as motors. { dā'rekt 'kə-rənt 'sər-kət }

direct-current circuit theory [ELEC] An analysis of relationships within a dc circuit. { dā'rekt 'kə-rənt 'sər-kət 'thē-ə-rē }

direct-current component [COMMUN] The average value of a signal; in television, it represents the average luminance of the picture being transmitted; in radar, the level from which the transmitted and received pulses rise. { dā'rekt 'kə-rənt kəm'pō-nənt }

direct-current continuity [ELEC] Property of a circuit in which there is an established pathway for conduction of current from a direct-current source. { dā'rekt 'kə-rənt ,kənt-ən'ŋi-əd-ē }

direct-current coupling [ELECTR] That type of coupling in which the zero-frequency term of the Fourier series representing the input signal is transmitted. { dā'rekt 'kə-rənt 'kəp-līŋ }

direct-current discharge [ELECTR] The passage of a direct current through a gas. { dā'rekt 'kə-rənt 'dis,čārj }

direct-current dump [ELECTR] Removal of all direct-current power from a computer system or component intentionally, accidentally, or conditionally; in some types of storage, this results in loss of stored information. { dā'rekt 'kə-rənt 'damp }

direct-current erase [ELECTR] Use of direct current to energize an erasing head of a tape recorder. { dā'rekt 'kə-rənt ə'rās }

direct-current generator [ELEC] A rotating electric machine that converts mechanical power into dc power. { dā'rekt 'kə-rənt 'jēn-ə,rād-ər }

direct-current inserter [ELECTR] An analog television transmitter stage that adds to the video signal a dc component known as the pedestal level. { dā'rekt 'kə-rənt in'sərd-ər }

direct-current motor [ELEC] An electric rotating machine energized by direct current and used to convert electric energy to mechanical energy. { dā'rekt 'kə-rənt 'mōd-ər }

direct-current motor control See electronic motor control. { dā'rekt 'kə-rənt 'mōd-ər kən'trōl }

direct-current offset [ELECTR] A direct-current level that may be added to the input signal of an amplifier or other circuit. { dā'rekt 'kə-rənt 'ōf,set }

direct-current picture transmission [COMMUN] Television transmission in which the signal contains a dc component that represents the average illumination of the entire scene. Also known as direct-current transmission. { dā'rekt 'kə-rənt 'pik-čar trānz,mish-ən }

direct-current plate resistance [ELECTR] Value or characteristic used in vacuum-tube computations; it is equal to the direct-current plate voltage divided by the direct-current plate current. { dā'rekt 'kə-rənt 'plāt ri,zis-təns }

direct-current power [ELEC] The power delivered by a dc power system, equal to the line voltage times the load current. { dā'rekt 'kə-rənt 'pau-ər }

direct-current power supply [ELEC] A power supply that provides one or more dc output voltages, such as a dc generator, rectifier-type power supply, converter, or dynamotor. { dā'rekt 'kə-rənt 'pau-ər səl,pplī }

direct-current quadruplex system [COMMUN] Direct-current telegraph system which affords simultaneous transmission of two messages in each direction over the same line, achieved by superimposing neutral telegraph upon polar telegraph. { dā'rekt 'kə-rənt 'kwā-drə,pleks 'sis-təm }

optical character recognition

optical character recognition [COMPUT SCI] That branch of character recognition concerned with the automatic identification of handwritten or printed characters by any of various photoelectric methods. Abbreviated OCR. Also known as electro-optical character recognition. { 'äp-tä-käl 'kar-ik-tär, rek-ig-nish-an }

optical communication [COMMUN] The use of electromagnetic waves in the region of the spectrum near visible light for the transmission of signals representing speech, pictures, data pulses, or other information, usually in the form of a laser beam modulated by the information signal. { 'äp-tä-käl ka,myü-na'kä-shän }

optical computer [COMPUT SCI] A computer that uses various combinations of holography, lasers, and mass-storage memories for such applications as ultra-high-speed signal processing, image deblurring, and character recognition. { 'äp-tä-käl kam'pyüd-ar }

optical coupler See optoisolator. { 'äp-tä-käl 'kəp-lär }

optical coupling [ELECTR] Coupling between two circuits by means of a light beam or light pipe having transducers at opposite ends, to isolate the circuits electrically. { 'äp-tä-käl 'kəp-liŋ }

optical data storage [COMPUT SCI] The technology of placing information in a medium so that, when a light beam scans the medium, the reflected light can be used to recover the information. { 'äp-tä-käl 'dad-ə, stōr-ij }

optical disk [COMPUT SCI] A type of video disk storage device consisting of a pressed disk with a spiral groove at the bottom of which are submicrometer-sized depressions that are sensed by a laser beam. { 'äp-tä-käl 'disk }

optical disk storage [COMPUT SCI] A computer storage technology in which information is stored in submicrometer-sized holes on a rotating disk, and is recorded and read by laser beams focused on the disk. Also known as laser disk storage, video disk storage. { 'äp-tä-käl 'disk 'stōr-ij }

optical electronic reproducer See optical sound head. { 'äp-tä-käl i,lek'trən-ik, rē-prə'dü-sär }

optical encoder [ELECTR] An encoder that converts positional information into corresponding digital data by interrupting light beams directed on photoelectric devices. { 'äp-tä-käl in'kōd-ar }

optical fiber [OPTICS] A long, thin thread of fused silica, or other transparent substance, used to transmit light. Also known as light guide. { 'äp-tä-käl 'fi-bär }

optical-fiber amplifier [COMMUN] A device for amplifying signals transmitted over optical fibers, consisting of a low-loss single-mode fiber made of basic silica glass, along whose length gain is generated by coupling pump light at either or both fiber ends, or at periodic locations in between. { 'äp-tä-käl, fi-bär 'am-plä,fi-ar }

optical-fiber cable See optical waveguide. { 'äp-tä-käl 'fi-bär 'kā-bäl }

optical-fiber sensor [ENG] An instrument in which the physical quantity to be measured is made to modulate the intensity, spectrum, phase, or polarization of light from a light-

emitting diode or laser diode traveling through an optical fiber; the modulated light is detected by a photodiode. Also known as fiber-optic sensor. { 'äp-tä-käl 'fi-bär 'sen-sär }

optical filter See filter. { 'äp-tä-käl 'fil-tär }

optical information processor See optical information system. { 'äp-tä-käl, in-fər'mā-shän, prə,ses-ar }

optical information system [COMPUT SCI] A device that uses light to process information; consists of one or several light sources, a one- or two-dimensional plane of data such as a film transparency, lens, or other optical component, and a detector. Also known as optical information processor. { 'äp-tä-käl, in-fər'mā-shän, sis-təm }

optical isolator See optoisolator. { 'äp-tä-käl 'i-sə, lād-ar }

optical lithography [ELECTR] Lithography in which an integrated circuit pattern is first created on a glass plate or mask and is then transferred to the resist by one of a number of optical techniques by using visible or ultraviolet light. { 'äp-tä-käl li'thäg-rə-fē }

optically coupled isolator See optoisolator. { 'äp-tä-käl 'kəp-əld 'i-sə, lād-ar }

optical mark reading [COMPUT SCI] Optically sensing information encoded as a series of marks, such as lines or filled-in boxes on a test answer sheet, or some special pattern, such as the Universal Product Code. Abbreviated OMR. { 'äp-tä-käl 'märk, rēd-ŋ }

optical mask [ELECTR] A thin sheet of video or other substance containing an open pattern, used to suitably expose to light a photoresistive substance overlaid on a semiconductor or other surface to form an integrated circuit. { 'äp-tä-käl 'mask }

optical memory [COMPUT SCI] A computer memory that uses optical techniques which generally involve an addressable laser beam, a storage medium which responds to the beam for writing and sometimes for erasing, and a detector which reacts to the altered character of the medium when it uses the beam to read out stored data. { 'äp-tä-käl 'mem-rē }

optical microphone [ENG ACOUS] A microphone in which the motion of a membrane is detected using a light beam reflected from it, either with the aid of an interferometer or by detecting the deflection of the beam. { 'äp-tä-käl 'mi-kra,fōn }

optical modulator [COMMUN] A device used for impressing information on a light beam. { 'äp-tä-käl 'mäj-ə, lād-ar }

optical mouse [COMPUT SCI] A mouse that emits a light signal and uses its reflection from a reflective grid to determine position and movement. { 'äp-tä-käl 'maüs }

optical processing [COMPUT SCI] The use of light, including visible and infrared, to handle data-processing information. { 'äp-tä-käl 'präs-es-ŋ }

optical proximity sensor [ENG] A device that uses the principle of triangulation of reflected infrared or visible light to measure small distances in a robotic system. { 'äp-tä-käl prāk 'sīm-əd-ē, sen-sär }